REVIEWS

EDITED BY JUDY V. GRABINER

All books, monographs, journal articles, and other publications (including films and other multi-sensory materials) relating to the history of mathematics are abstracted in the Abstracts Department. The Reviews Department prints extended reviews of selected publications.

Materials for review should be sent for abstracting as indicated in the heading of the Abstracts Department. Publishers who wish to speed up the process of abstracting and subsequent reviewing may send a second copy directly to the editor of the Book Review Department: Professor Judy V. Grabiner, 424 West 7th Street, Claremont, CA 91711, USA.

Most reviews are solicited. However, colleagues wishing to review a book are invited to make known their wishes. Comments on books, articles, or reviews should be submitted to the Correspondence Department. We welcome also retrospective reviews of older books. Colleagues interested in writing such reviews should check first with the editor to avoid duplication.

SEKI TAKAKAZU ZENSHU [Takakazu Seki's Collected Works]. Edited and explained by A. Hirayama, K. Shimodaira, and H. Hirose. Osaka (Osaka Kyoiku Tosho). 1974. xviii + 852 pp.

Reviewed by Toshio Matsuzaki
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In the Edo period (1603-1867) Japan had her own mathematics, and Takakazu Seki (1642?-1708) was the most distinguished scholar of the old Japanese mathematics. Yet his achievements are not well known even in Japan, because most of his works have been handed down to us in manuscript form, and the mathematical notations and expressions which he used are quite different from those of today.

Seki's school was developed from generation to generation by his followers, so it sometimes happened that the founder's name was pirated to books by others. Therefore, the first difficult task for anyone who wishes to compile Seki's works is to collect his books, manuscripts or those copies with such a signature as "by Seki", and carefully ascertain whether those materials are Seki's real works or not.

Another problem is that the written copies often contain mistakes. As Seki's mathematical achievements were on an exceedingly high level, his followers, who could not fully understand his writings, copied and re-copied them through the ages, adding new errors each time. After Seki's death, his

disciple M. Araki selected some mathematical achievements from Seki's manuscripts, arranged them in the form of a book, and issued them in four volumes. Even in this book, however, there are a great many misprints. Since Seki's works were beyond his grasp, this compiler could not detect those mistakes before printing, yet the mistakes were later corrected by Y. Matsunaga, disciple of Araki. He made notes as to the right results on the margins of the book. The editors found this book only a few years ago, and it has made a great contribution to making Seki's collected works complete.

It is no easy task to find Seki's writings in all kinds of libraries throughout Japan, to decide whether or not they are genuine after minutely examining them, and to correct errors, if any, by re-computing the problems in the works. Dr. A. Hirayama, chief editor of the present book, has been pursuing this laborious investigation for over thirty years. He said in the preface to the book: "We are sure there is no book that can be regarded as Seki's writings except those which are compiled in this book."

Another difficulty in publishing Seki's works lies in printing techniques. Mathematical notations or signs which were used in the works are entirely different from those used nowadays, and even the letters in them are mostly out of use. Moreover, many complicated geometrical figures were also employed. So it is difficult to print his works in nearly the same form as the original. It would cost a great deal to publish a book which meets those conditions. Time after time for the past hundred years or so, the publication of Seki's collected works has been planned, but such schemes have fallen through owing to the difficulties mentioned.

The single exception to this is the publication of *Sekiryu Sampo Shichibusho* [Seki's Seven Texts on Mathematics] in 1907 to commemorate the two-hundredth anniversary of Seki's death. It contains quantitatively about one-sixth of the whole works. This memorial publication was executed by leading members of the Tokyo Mathematical and Physical Science Society: D. Kikuchi, H. Nagaoka, T. Hayashi, T. Takagi, etc. The preface says: "To compile and publish Seki's complete works is anything but a task that can be carried out overnight." In point of fact it was seventy years later that they had their wishes fulfilled.

Seki's Collected Works consist of four parts:

I. Life and Works of T. Seki, and Bibliography. 64 pages.
II. Original Texts. 572 pp.
III. Japanese Explanations. 131 pp.
IV. English Explanations. 85 pp.

The list of Seki's main achievements in mathematics is shown in the Explanations, and its eighteen items read as follows:

1. Algebraic expressions and how to calculate them.
2. Completion of Horner's method for the solution of

algebraic equations with numerical coefficients.
3. Discriminant of an equation and partial conditions for existence of positive and negative roots.
4. Newton's approximation method for roots of equations.
5. The first step toward maximal and minimal theory.
6. Discovery of determinants.
7. The first step toward the calculation of continued fractions.
8. Solution of indeterminate equations.
9. Some solutions of problems in calculus of finite differences.
10. Discovery of Bernoulli's numbers.
11. Relations between the side of a regular polygon and the radius of the circumscribed circle, or the radius of the inscribed circle.
12. Calculations concerning the circle.
13. Use of Newton's interpolation formula.
14. The first step toward the theory of conic sections.
15. Use of Pappus-Guldin's theorem.
16. Volume of the sphere.
17. Magic squares and magic circles.
18. Some mathematical recreations.

Seki also investigated some astronomical problems related to the making of a calendar, and got several new results. One of the editors, Dr. H. Hirose, assumes that this fact reflects the existence of mutual stimulations between astronomical and mathematical fields, and expounds his new theory in the Explanations.

The brilliant achievements Seki produced in either sphere are explained in detail. Some of them are already known to oversea students through several articles and books which were written in English and published during the first ten years of the present century. From that time on, however, remarkable progress has been made in the historical research on old Japanese mathematics, so that any student who wishes to know about Seki and his works should first refer to the English Explanations of this book. If he wants to get further information, or to make a study of Seki's works, then he must read the original texts in Japanese. *Seki's Collected Works* are, indeed, a reliable source book, and an excellent research source about Seki as well. It will always remain valuable in studying the history of old Japanese mathematics. The reviewer, therefore, recommends this book to those students of the world who are interested in the development of natural science in Japan.